Acadia National Park

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An Experiment Using Signs to Reduce Visitor-Built Cairns in Acadia National Park

Cairn Garden, East Slope Dorr Mountain Trail.

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EXECUTIVE SUMMARY

In the summer of 2002, we conducted an experiment using signs to combat the issue of rock dislocation. Hikers in Acadia National Park frequently add to cairns that mark trails, knock them down, or build their own cairns and other rock objects. Many of these rocks are removed from thin mountain soils exposing more soil and plants to erosion. Extra cairns and other objects also degrade the mountain landscape and may create safety problems if hikers stray off trail.

On a one-mile section of the South Ridge Cadillac Trail, we built 67 Bates cairns. Bates cairns are generally made from four stones in a pagoda-like structure, and they are very easy to monitor for alterations. For 30 days, we monitored the condition of the cairns every five days, restoring them to their original condition on each hike. We then installed three signs at either end of the trail section and in the middle, and repeated the monitoring runs every five days for 30 days, restoring their condition on each hike.

The average percent of intact cairns increased from 64% (n=42) to 81% (n=54) with the addition of signs. The average percent of cairns with added rocks decreased from 31% (n=21) to 12% (n=8). *Each of these changes was statistically significant at the .05 level.*

While the signs were reasonably effective in reducing the occurrence of the rock dislocation behavior, many questions remain. Was the reduction enough to justify keeping the signs in place? What level of cairn maintenance can be sustained? What other education tactics can be employed? How much effort should the park expend on this problem?

Based on this experiment, we will recommend to the park sign committee leaving at least some of the signs in place for the 2003 season. We will also recommend conducting the same experiment on the Gorham Mountain Trail. With far more hikers per day and perhaps a different type of hiker (less experienced), it is worth seeing if the same results occur.

ACKNOWLEDGEMENTS

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INTRODUCTION

Rock cairns have long been the standard trail markers to guide hikers above treeline or in other areas where there are no trees. Early trail enthusiasts built cairns to mark trails on most of the exposed granite summits and ridges of Acadia National Park more than 100 years ago. Today these trails offer outstanding views to thousands of hikers of the surrounding mountains and the spruce-clad islands of the Maine archipelago.

Doubtless, early trail builders were sometimes frustrated by hikers adding to cairns, knocking them down, or building new ones. Hikers added rocks to the summit cairns regularly as an ongoing tradition in many areas. One hundred years ago it was a small problem. With several thousand hikers striding off into Acadia via trails every summer day, it is a substantial ongoing problem for park managers. Few hikers realize how much they have altered the natural summit landscape with the relentless shuffling and reshuffling of rocks. We will refer to the various manifestations of this problem (adding rocks, building cairns and other objects, destroying cairns) as rock dislocation.

Park managers consider rock dislocation a problem for three reasons:

1. Natural resource degradation: rocks are removed from pockets of shallow mountain soil, exposing the soil to erosion and damaging habitat for plants and animals such as small invertebrates; extra cairns lead people off trail adding to soil and vegetation loss;
2. Visitor experience degradation: the natural landscape (the main reason Acadia was created) is degraded by the additional cairns and other rock objects constructed by hikers;
3. Safety: when visibility is low, extra cairns may lead people off trail into hazardous areas, or cause them to become lost; this problem is more acute in winter.

Over the past few years, park staff have tried to educate hikers about the applicable Leave No Trace Principle, *Leave What You Find*, in a variety of ways. We educated park staff to educate visitors. We constructed a cairn exhibit for the visitor center. We wrote articles for the local newspaper and park publications. We sent staff and volunteers out on trails to talk to hikers. But we have not had any quantitative method of measuring the success of these efforts. Although we may have made some headway, the difficulty of reaching several thousand hikers every day is immense.

OBJECTIVES

In this report, we present the results of an experiment using trailside signs to educate hikers to *Leave What You Find*. Our hypothesis is that the use of signs will reduce the occurrence of the rock dislocation behaviors.

METHODS

Cadillac Mountain, with three hiking trails and an auto road terminating at its summit, has been prime rock dislocation site for at least 20 years. In 2000, we developed several Leave No Trace signs for the immediate summit area with its tourist walkway. One of these addressed rock dislocation, and we placed several of them along and near the Gorge Path, which ends at the

summit walkway. The Gorge Path cairns and nearby rocks were dislocated frequently by visitors. This text of this sign read:

> "Cairns are carefully placed piles of rocks built by trail crews to mark trails and guide hikers. Adding to cairns or building other cairns or rock objects detracts from the natural landscape, causes soil erosion and plant loss, and misleads hikers. Do not add to or build cairns or other rock objects. Leave the mountain and the rocks as you find them."

In 2002, we conducted an experiment using these signs on the South Ridge Trail up Cadillac Mountain (Figure 1). The upper part of this trail near the summit has also been a problem area for rock dislocation. The trail has about 50-100 hikers daily ascending 3.5 miles to the summit. Other tourists wander down the trail from the summit short distances (numbers unknown). This section of the Cadillac South Ridge Trail is mostly exposed bedrock—open slabs of granite—with many loose rocks lying around. The West Face Trail intersects with the upper part of South Ridge Trail ¼ mile from the Cadillac Summit.

On June 21, 2002, we straightened up the 67 Bates cairns marking the one mile section of trail from the junction of the Canon Brook Trail to the Cadillac Summit. Bates cairns are a simple four stone cairn pioneered at Acadia by early pathmaker Waldron Bates around the turn of the century (Figure 2). The Bates cairn is very simple to observe and measure changes to, unlike the traditional conical cairn built of many rocks. Park staff revived the Bates cairn in 2001 (conical cairns had been used for many years) for two reasons. First, it was historic, and reestablishing Bates cairns would restore some historic integrity to the trails. And second, Bates cairns would be easier to build and maintain.

For the next 30 days (June 21-July 21), we hiked this trail section south to north (to the summit) every five days recording data about the condition of each cairn. We recorded the number of intact cairns, cairns destroyed (knocked down), cairns with added rocks, cairns with removed pointer rocks (the top rock, which points in direction of the trail), copycat Bates cairns, and other copy cat conical cairns. We also recorded the presence of other rock art. During each hike we restored cairns to their original condition, and destroyed all other cairns and rock art.

Figure 2: Bates Cairn

On the morning of July 22, we installed signs at three locations: Sign 1 - the south end of the trail section at its junction with the Canon Brook Trail; Sign 2 - embedded in the large conical cairn for the trail sign at the West Face Trail junction, and Sign 3 - just below (south) the side path coming from the nearby

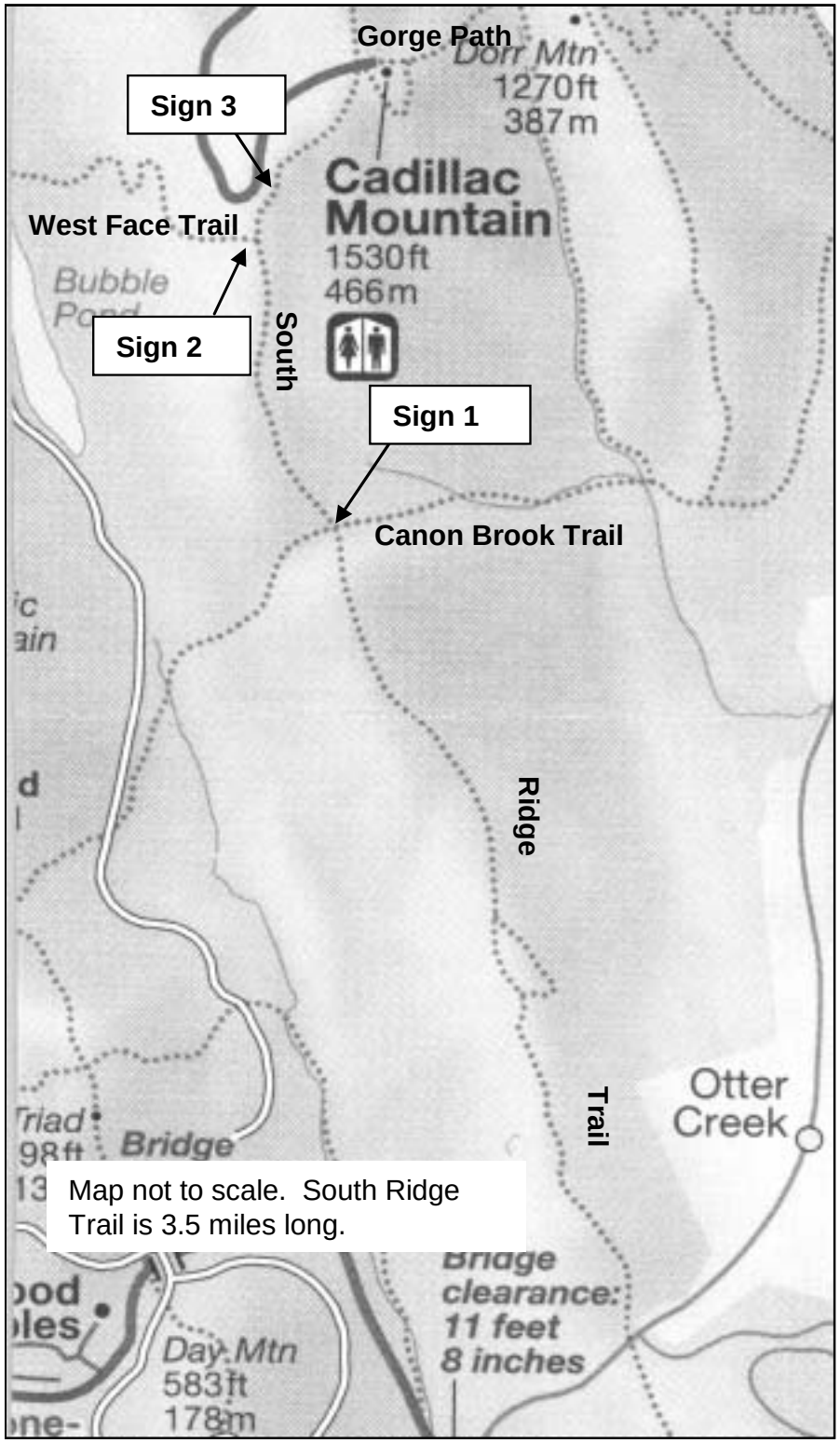

Figure 1: Sign locations, South Ridge Trail for Cadillac Mountain.

Blue Hill Overlook on the Cadillac Summit Road (Figure 1). Over the next 30 days (July 22-August 20), we once again hiked the trail again every five days recording cairn condition data, restoring the Bates cairns, and destroying other cairns and rock objects.

Statistical methods were straightforward. We calculated the average number of intact cairns, cairns destroyed, cairns with added rocks, cairns with removed pointer rocks, copycat Bates cairns, and other copycat cairns without signs and with signs. For each of these averages, we calculated the percentage based on 67 cairns. We then performed a means test for differences (without signs, with signs) for two variables—the number of intact cairns and the number of cairns with added rocks; these dislocations of rocks occurred most frequently.

RESULTS

By far the most common cairn alteration was adding rocks, followed by removing the pointer rock. Data for all variables are shown in Table 1. A statistical worksheet, including variances, is in Appendix 1.

Table 1: Condition of Cairns Along the South Ridge Cadillac Trail With and Without the Use of Signs.

Date	Total Cairns	Intact Cairns	Cairns Destroyed	Cairns with Added Rocks	Cairns with Removed Rocks	Copycat Bates Cairns	Other Copycat Cairns
Without Signs (Control)							
06/21/2002	67	67	0	0	0	0	0
06/26/2002	67	49	1	13	4	0	1
07/01/2002	67	51	0	15	1	1	2
07/06/2002	67	36	0	27	4	1	0
07/11/2002	67	42	0	16	9	4	1
07/16/2002	67	44	0	19	4	1	1
07/21/2002	67	34	0	33	0	1	3
	Total	256	1	123	22	8	8
	Average	**42.67**	0.17	**20.50**	3.67	1.33	1.33
	Percent (Avg/67)	**63.68**	0.25	**30.60**	5.47	1.99	1.99
With Signs (Experiment - signs installed 7/22)							
07/22/2002	67	67	0	0	0	0	0
07/26/2002	67	43	0	22	2	0	3
07/31/2002	67	58	0	5	4	1	3
08/05/2002	67	58	0	8	1	0	1
08/10/2002	67	51	4	1	11	4	4
08/15/2002	67	58	0	4	5	0	1
08/20/2002	67	58	0	7	2	0	0
	Total	326	4	47	25	5	12
	Average	**54.33**	0.67	**7.83**	4.17	0.83	2.00
	Percent (Avg/67)	**81.09**	1.00	**11.69**	6.22	1.24	2.99

Other alterations were relatively uncommon, although we know from experience hikers have sometimes destroyed six or more cairns in a short period. The average percent of intact cairns increased from 64% (n=42) to 81% (n=54) with the addition of signs. The average percent of cairns with added rocks decreased from 31% (n=21) to 12% (n=8). *Each of these changes was statistically significant at the .05 level (see Appendix 1).*

DISCUSSION

We recognize that just one or a few hikers may be responsible for most of the Bates cairn alterations between each monitoring hike. It's easy to add a rock or remove the pointer from a Bates cairn. Is it more tempting to add a rock to a Bates cairn than a traditional conical cairn? Children in particular may be tempted to add rocks with or without the encouragement of parent. We know from an observational study on Cadillac Mountain (LaPage 2001) that children are involved in some cairn building activity. We also know that some rocks used are far too large for children to be manipulating.

Although the reduction in cairn alteration was statistically significant, was it enough to warrant keeping three signs out along the trail? Would park managers be willing to install many more signs throughout the trail system to combat this problem? Is it worth leaving these signs intact because they reach many people in the high use area of the Cadillac Summit? Should we try these signs on an even busier trail such as the Gorham Mountain trail, which has 300-400 hikers a day in the summer? Maintaining cairns every five days, even Bates cairns, is probably unsustainable. How frequently can these cairns be maintained? How much effort should we expend to mitigate this one problem? These are difficult questions for which the park has yet to find an answer.

Five years in to an active program of Leave No Trace education it is difficult to claim much progress has been made in reducing rock dislocation. Clearly, signs alone, while helpful, will not solve the problem. However, all options have not been exhausted. Use of space in the summit gift shop may help reach many visitors. There is little LNT education occurring in park campgrounds. More nonagency media, such as tourist publications are available. A poster prepared for the George Wright Society meeting may be used in other park locations such as the Visitor Center.

Based on this experiment, we will recommend to the park sign committee leaving at least some of the signs in place for the 2003 season. We also recommend conducting the same experiment on the Gorham Mountain Trail. With far more hikers per day and perhaps a different type of hiker (less experienced), it is worth seeing if the same results occur.

LITERATURE CITED

Turner, R. and W. LaPage
2001 Visitor behaviors and resource impacts at Cadillac Mountain, Acadia National Park. Unpublished manuscript. June 2001. Acadia National Park files. 113 pp.

APPENDIX 1: Statistical Analysis and Means Testing for Intact Cairns and Cairns With Added Rocks.

	Intact Cairns					Added Rocks				
	Control	Treatment				Control	Treatment			
	49	43				13	22			
	51	58				15	5			
	36	58				27	8			
	42	51				16	1			
	44	58				19	4			
	34	58				33	7			
Control			***Treatment***			***Control***		***Treatment***		
Mean	42.666667		Mean	54.33333		Mean	20.5	Mean	7.833333	
Standard Error	2.7768887		Standard Error	2.538591		Standard Error	3.201562	Standard Error	3.004626	
Median	43		Median	58		Median	17.5	Median	6	
Mode	NA		Mode	58		Mode	NA	Mode	NA	
Standard Deviation	6.8019605		Standard Deviation	6.218253		Standard Deviation	7.842194	Standard Deviation	7.359801	
Variance	46.266667		Variance	38.66667		Variance	61.5	Variance	54.16667	
Kurtosis	-1.654922		Kurtosis	1.870541		Kurtosis	-0.56942	Kurtosis	3.946782	
Skewness	-0.1071907		Skewness	-1.61649		Skewness	0.96103	Skewness	1.839515	
Range	17		Range	15		Range	20	Range	21	
Minimum	34		Minimum	43		Minimum	13	Minimum	1	
Maximum	51		Maximum	58		Maximum	33	Maximum	22	
Sum	256		Sum	326		Sum	123	Sum	47	
Count	6		Count	6		Count	6	Count	6	
Confidence Level(0.950000)	5.442602		Confidence Level(0.9	4.975547		Confidence Level(0.9	6.274946	Confidence Level(0.9	5.888959	
F-Test: Two-Sample for Variances						F-Test: Two-Sample for Variances				
	Control	***Treatment***					***Control***	***Treatment***		
Mean	***42.666667***	***54.333333***				Mean	20.5	7.833333		
Variance	46.266667	38.666667				Variance	61.5	54.16667		
Observations	6	6				Observations	6	6		
df	5	5				df	5	5		
F	1.1965517					F	1.135385			
P(F<=f) one-tail	0.4243491					P(F<=f) one-tail	0.446292			
F Critical one-tail	5.0503291					F Critical one-tail	5.050329			
t-Test Two Sample Assuming Equal Variance						t-Test Two Sample Assuming Equal Variance				
	Variable 1	***Variable 2***					***Variable 1***	***Variable 2***		
Mean	42.666667	54.333333				Mean	20.5	7.833333		
Variance	46.266667	38.666667				Variance	61.5	54.16667		
Observations	6	6				Observations	6	6		
Pooled Variance	***42.466667***					Pooled Variance	57.83333			
Hypothesized Mean Difference	0					Hypothesized Mean D	0			
df	***10***					df	10			
t	-3.1008684					t	2.884921			
P(T<=t) one-tail	0.005617					P(T<=t) one-tail	0.008124			
t Critical one-tail	1.8124611					t Critical one-tail	1.812461			
P(T<=t) two-tail	0.011234					P(T<=t) two-tail	0.016248			
t Critical two-tail	2.2281389					t Critical two-tail	2.228139			